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been made the rate of increase in tonnage was rapid. During the third five-year period the traffic was 217 per cent. of that of the second five-year period. During the fourth five-year period the traffic was 286 per cent. of that of the second five-year period, and during the sixth quinquennial period—1895–1899—the tonnage was 401 per cent. of the traffic during the years 1875–1879. During the last quinquennial period of the twenty-five years from 1875 to 1899 the traffic of the Suez Canal was four times that of the first five years of that period. During the second decade of the operation of the Suez Canal—that is, from 1880 to 1890—there was an increase of 125 per cent. tonnage over the previous decade.

If it be assumed that the tonnage of the American canal during the first ten years of its operation will increase only one-half as fast as the traffic of the Suez Canal did during the second decade of its existence, the rate of growth predicted for the Panama Canal will be $62\frac{1}{2}$ per cent. An increase of $62\frac{1}{2}$ per cent. in the estimated figures for 1914—approximately, 7,000,000 tons—would give a tonnage of about 11,250,000 for the year 1954. It would be difficult to conceive of a more conservative estimate than this, and yet it shows a relatively large prospective traffic for the American canal at the the close of the first ten years. The figures for the American canal for 1924 are about the same as those for the present tonnage of the Suez Canal. The traffic of the Suez waterway in 1914 will probably be at least one and one-half times its present amount.

THE EXPLORATIONS OF THE RUSSIAN HYDROGRAPHIC EXPEDITION IN THE ARCTIC OCEAN IN 1902.*

The Russian Hydrographic Commission reports, concerning the fifth season of field work in the Arctic Ocean during the summer of 1902, that important progress was made in the survey of the coast-line and in the sounding and survey of the Kara Sea and of the shoals on the White Sea. Much material was obtained for the correction of the very imperfect existing charts of the region. During the frequent interruptions of survey work, on account of the ice, meteorologic, magnetic, tidal, and current observations were made, and dredging was done for the collection of material

* Condensed from *Annalen d. Hydr. u. Marit. Meteorologie*, 1903, Heft XI, p. 492.

for the study of the fauna and the flora of the Arctic. The expedition consisted of two Archangel steamers, the *Pachtusoff* and the *Lieutenant Oftsyn*, of which the latter took part only in the work in the northern part of the White Sea. The leader of the expedition, Captain A. Warnek, was upon the *Pachtusoff*. The late spring and the consequent position of the ice did not permit the ships to leave Archangel until 7/20 June.

The first task of the season was the survey of the Orloff shoals—a difficult matter, because they are narrow, and some are only about a mile in length. The dangerous western boundary of the shoals was found to be $2\frac{1}{2}$ nautical miles nearer the coast than was indicated on the charts. The least depth of water on the shoals was determined as 4 feet, instead of 12 feet, as indicated on the charts. Seven fathoms was the least depth noted in the channel between the shoals and the coast, and the whole bottom was found to be incorrectly given on the charts. The average temperature of the air from 8/24 June to 21 June/7 July was $+2.1^{\circ}\text{C}$, with a minimum of -0.5°C . on 14/27 June, and a maximum of $+6.9^{\circ}\text{C}$. on 22 June/5 July. Snow fell five times. At the Orloff lighthouse, on the coast, the extremes were somewhat greater. The tide interval, as determined at the Orloff lighthouse, is about 10 hours 21 minutes. Spring tide rises 19 feet 6 inches, neap tide 10 feet 4 inches, but these values are greatly affected by the wind. The strongest current was found on the Gorjainoff Bank, where it amounts to $3\frac{1}{2}$ nautical miles per hour, toward S. W. during flood, and toward N. E. during ebb. The wind had little effect upon either direction or velocity of the currents.

After finishing the work upon the Orloff banks, the ships returned to Archangel for supplies, and on 3/16 July the *Pachtusoff* started alone for the mouth of the Petchora River. The attempt to pass north of Kolgujeff Island was unsuccessful on account of ice, and the ship had to turn back and take the southern route.

A survey of the coast of the Russian Cape (Russky Saworot) peninsula was made. The position of the extremity of the Cape was found to be $68^{\circ} 58\frac{1}{4}' \text{ N.}$, $54^{\circ} 35' \text{ E.}$, $3\frac{1}{2}$ minutes farther east, and $\frac{3}{4}$ minute south of the position given on the old charts. Shoals are lacking from the north shore of the peninsula, and the 5-fathom line is about half a mile from the coast. Unusually warm weather prevailed, the average temperature on 8 July being $+16.5^{\circ}\text{C}$. in air and $+15^{\circ}\text{C}$. in the ocean. Within the Petchora estuary the water was considerably warmer ($+19.5^{\circ}\text{C}$. near Nikitsa on 20 July/2 August).

The *Pachtusoff* left the Petchora River on 26 July/8 August, and proceeded to the Kara Strait, where a surveying party was left on Waigatch Island. After two unsuccessful attempts to enter the Kara Sea—great quantities of ice still blocking the way—the steamer explored the the northwest side of Waigatch and discovered an anchorage which is protected from all winds and from moving ice. This is the only anchorage in the region, and it is of particular importance to ships making for Nova Zembla. Coal ships could winter here comfortably, there being plenty of fresh water upon Waigatch near at hand, and there being no danger of crushing by the ice. The value of “Pachtusoff Roadstead,” as it was christened, is increased by its entrance being from the Arctic Ocean, and not from the Kara Sea. It is easy to find and to enter, and the expedition set beacons along the proper channel.

On 16/29 August the steamer went to the Yugor Strait to begin the survey of the southwest coast of the Kara Sea. Fifty years had elapsed since the last preceding Russian surveys were made along this coast. The *Pachtusoff* was weather-bound for several days in a protected bay, which Captain Warnek discovered in 1900 in the southwest part of Waigatch Island, and the survey work was brought to an end on 25 August/7 September by the closing of the season. Another good anchorage was discovered in the strait between Mjestny Island and the coast. Soundings decrease gradually from 18 to 20 fathoms near Mjestny Island to 7 fathoms near the mouth of the Kara River. From the mouth of the Kara the depth of the water increases regularly to a point 18 nautical miles E. N. E. from Mjestny Island, where 95 fathoms was found. The depth of the Kara Sea has been greatly exaggerated. At the spot where Russian Admiralty chart No. 432 shows the maximum sounding as 406 fathoms the present survey found but 100 fathoms, and the deepest portion measured in 1902 gave but 120 fathoms. The salt content of the water of the southern part of Kara Sea is rather high, and it decreases very little on going toward the Baidaratskaia Bay, from 1.0250 at the Yugor Strait to 1.0185 near the mouth of the Kara. The temperature of the water likewise increased in the same direction.

In Kara Strait the expedition found very uneven bottom, with remarkably rapid changes in the soundings. At one time 9 minutes of slow steaming brought the ship from a sounding of 65 fathoms to one of 5½ fathoms. Both ends of the strait show deep water—80 fathoms at the west end, 60 fathoms at the east end—with much shallower water in the middle. Upon the submerged ridge, which

extends from Waigatch Island toward Nova Zembla, the maximum sounding was determined at 25 fathoms, but nothing of 20 fathoms or less was found.

The following magnetic observations were among those made by the expedition:

Orloff lighthouse, 7.30 P.M., 11/24 June.....	Decl., 8° 18.4' E.
Russian Cape (Russky Saworot) Penin., 8 P.M.,	
8/21 July.....	" 16° 8.8' E.
Northwest coast of Waigatch Island, 10 A.M.,	
28 July/10 August.....	" 18° 47.8' E.
Near the mouth of the Kara River, 10 A.M.,	
25° August/7 September.....	" 19° 33.5' E.

E. O. H.

ALASKAN CABLES AND TELEGRAPHS.

The accompanying map is reduced from the new War Department map showing the completed cable lines in Alaskan waters, those that are proposed and are to be carried out next year, the telegraph lines now in operation in the Territory, and the British Columbia land line from Ashcroft, on the Canadian Pacific R.R., to Dawson and Eagle.

It is expected that the cable from Seattle to Sitka and Juneau will be laid in April next. The cable, 1,300 miles in length, was manufactured near New York City after Congress had authorized the line on March 3, 1903, and was delivered at San Francisco in the fall. The route from Seattle to Sitka was surveyed by Capt. J. F. Pratt, of the Coast and Geodetic Survey.

The cable route passes from Puget Sound out into the Pacific to the west of Vancouver Island and the Queen Charlotte Islands, and then makes straight for the south end of Baranov Island, on which Sitka is situated. At the south end of this island one branch will be laid north to Sitka and the other northeast through the coastal channels to Juneau.

The map shows that two cable lines in Alaskan waters have already been completed. One of them extends from Juneau up Lynn Canal to Skagway; the other connects St. Michael with Nome, the centre of the largest placer gold-mining industry in